and Charles Deane, Moses Coit Tyler, W. B. Weeden, and Ephraim Emerton.

Dr. Edward Channing of Harvard college then read a paper in which he maintained that the early settlers of the English North-American colonies did not leave behind them the experience in the management of local affairs which they had inherited from their ancestors, and which formed one of the most precious inheritances of the English race; but that they brought such experience to this country, and there applied it so far as the peculiar conditions of their environment would permit. He further said, that he thought the English common-law parish of 1600 was the most important connecting link between the institutions of the English race in their two homes; and he gave some examples of this connection. Dr. Charles Deane gave the pith of the argument advanced by Judge Aldrich, at a recent meeting of the Antiquarian society, that the New-England town system was but a legislative creation. Dr. H. B. Adams said that in his opinion there was not one institution of early New England which did not have its analogue in the institutions of old England, and he thought that the author of the paper under discussion had found the connecting link. Judge Chamberlain of the Boston public library endeavored to show that the two theories were not inconsistent, and likened the experience that the New-England fathers had brought with them to a grain of English wheat, which when planted in our soil reproduced its kind so far as circumstances would permit. President White, in closing the discussion, remarked that he considered the paper an example of the union of the analytic and synthetic methods which he had advocated.

Mr. C. H. Levermore of Johns Hopkins then read an able essay on the founders of New Haven, — John Davenport and Theophilus Eaton, — who had strengthened class distinctions at the outset in their colony, and had created a ruling caste of Brahmins.

Prof. T. M. Crane of Cornell described some new sources of mediaeval history which he has recently opened up. He thought the field would be an attractive one, both from the large amount of new material, and also from the new methods applied to old material such as local traditions, popular songs, and folk-tales, which often contained details not to be found in written history. A still more curious source was the collections of stories with which the preachers of that time enlivened their sermons; each in itself of little value, but forming, *en bloc*, invaluable material for the historian. This new method of study would re-act most favorably upon the study of our own history, and encourage the collection of local traditions, folk-songs, and tales; of which an excellent beginning has been made in Allen's Slave songs of the South, and Newell's Songs and games of American children. President White spoke of the importance of Professor Crane's work, and then introduced Dr. Francke of Harvard college; who described the founding and progress of the *Monumenta Germaniae*, with which he had been associated for two years. Justin Winsor closed the session with an account of the Narrative and critical history of America that he is now editing, and of which two volumes are already printed although not published.

At a public session in the afternoon, Professor Tyler of Cornell presented a rather commonplace and eulogistic paper upon the influence of Thomas Paine on the declaration of independence; and Professor Austin Scott — formerly associated with George Bancroft — read an essay on the constitutional development of the United States. The intense heat interfered with the author's delivery, and also with the taking of notes; but it may be said that the author maintained that what he termed the federative principle was the key to our constitutional history, and he traced its action with great care and detail through the successive periods of our national growth. It is to be hoped that Mr. Scott will still further elaborate and publish his paper, which showed considerable ability and thought.

NOTES ON THE ELECTRICAL CONFERENCE.

THE Electrical conference, called together by the commission appointed by the president of the United States, met in Philadelphia on Monday, Sept. 8, and continued its sessions throughout the week. The first meetings were held in the lecture-hall of the Electrical exhibition; but on account of the bad acoustic properties of that room, the sessions after Tuesday took place in the hall of the Franklin institute.

About one hundred and seventy-five delegates were invited by this commission to be present, and constitute the conference. Of these the greater number were American investigators and electricians, but a number of foreign conferrees were also included. Of these it should be mentioned, that there were present Sir William Thomson, who was also vice-president of the conference; Professor Fitzgerald of the University of Dublin; Professor Oliver Lodge of Liverpool; Mr. W. H. Preece of the English postal telegraph; Professor Arthur Schuster of Manchester; and Professor Silvanus P. Thompson of University college, Bristol.

The conference was designed to be representative of all interested in progress in electrical knowledge; and so not only were those present who are more concerned with the purely theoretical questions involved, but also those especially occupied in developing applications of electricity.

Prof. Simon Newcomb, on behalf of the commission, opened the conference in a brief address of welcome, and also stated the objects for which the conference had been called. He was followed by the president of the conference, Prof. Henry A. Rowland, who delivered a carefully prepared and very interesting address, in which were discussed, among other things, the interdependence of applied and pure science, some of the questions still open in electrical science, and the need of more careful training in the *theory* of electricity in technical schools.

Sir William Thomson then made a short address, after which the conference adjourned to meet on Tuesday, when the regular discussions were begun.

The object of the conference was to take authoritative action respecting the electrical standards recommended by the international convention; to consider the advisability of recommending the establishment by the government of a bureau of physical standards; to consider what could be done by the U. S. signal-service, with the co-operation of the various telegraph and telephone companies, towards increasing our knowledge of atmospheric electricity and earth-currents; and to discuss subjects in which the knowledge possessed by those acquainted with the theory of electricity could be brought to the aid of those engaged in the applications of the science. The sentiment of the conference was in favor of adopting the electrical standards recommended by the international convention which met at Paris last April; but, as considerable difference of opinion exists as to the best standard of light to be adopted, the whole subject of the electrical standards was referred to a committee which is to report to the commission within three months. In the discussion of the adoption of the legal ohm, as defined by the Paris convention as the resistance of a column of pure mercury at zero degrees centigrade, of one square millimetre cross-section and one hundred and six centimetres in length, it was brought out that the results obtained in the experiments which have been carried on during the past year under Professor Rowland's direction, give very nearly 106.28 centimetres as the length of the column of mercury which represents the *true* ohm.

The subject of the best methods of extending our knowledge of atmospheric electricity and earth-currents, and any possible relation that may exist between them and the weather, was introduced by Professor Abbe of the signal-service. He represented the importance of the subject, and that by using suitable methods, and by the co-operation of the various telephone and telegraph companies, much valuable information might be obtained, and without interfering with the regular work of the lines employed. Sir William Thomson called attention to the fact, that in the study of earth-currents the quantity to be measured is the difference of potential between the points of observation. By such measurements the distribution of potential at any time over the country examined may be mapped and studied.

The question of the establishment of a bureau of physical standards was introduced by Professor Snyder, who pointed out the advantages which would result from having physical standards preserved and verified under government supervision. Work which is now being done by different observers all over the country, and in a way which is often necessarily incomplete from the lack of funds, could thus be done at a central laboratory, more cheaply, effectively, and accurately; and thus the physicists now engaged in these laborious determinations and comparisons would be free to occupy themselves with investigations looking to the discovery of new truth. In the discussion which followed, Professor Rogers of Cambridge, Mass., urged that the bureau should engage in auxiliary research, and showed how this was necessary for the accurate establishment of units. Lieut. Allen of the signal-service read a paper giving an account of the success that had attended the work of that department in obtaining accurate standards for thermometry and barometry. Professor Hilgard, superintendent of the U. S. coast-survey, was not in favor of such a bureau, on the ground that it would discourage private research, and that the present bureau of weights and measures met every requirement. Professor Simon Newcomb spoke in favor of the proposed bureau; and Sir William Thomson not only favored the idea, but thought that instruments of the accuracy required by such a bureau for its work would soon be devised and constructed, and the time was therefore ripe for such action to be taken. Finally the conference adopted a resolution to the effect that it deemed it of national importance that Congress should fix standards of electrical measures, and establish a bureau charged with the duty of examining and verifying instruments for electrical and other physical measurements. The commission was urged to bring the matter before congress; and it was left with them to decide upon the manner of the carrying-out of the idea, whether by a special bureau, or by enlarging the powers and duties of existing departments.

Among the discussions that occupied the attention of the conference, perhaps the most interesting one was that opened by Prof. Henry A. Rowland, upon the theory of the dynamo-electric machine. Professor Rowland maintained, that, neglecting the question of strength and rigidity and other such mechanical reasons, a single magnetic circuit is better than a double one: meaning, by a single magnetic circuit, such a one as would be obtained by placing the armature between the poles of an ordinary horseshoe magnet; and by a double magnetic circuit, one of the form obtained by putting two horseshoe magnets end to end with their similar poles together, and putting the armature between the compound north and south poles thus formed. In the single circuit the lines of force, after passing through the armature, can only return in one way through the magnet; in the double circuit, however, the lines of force can return by passing around either through one magnet or the other. Professor Rowland is of the opinion that there is far more leakage of the lines of force in the case of the double circuit than in the case of the single; and therefore, other things being equal, the single circuit is the better form. This is, however, a question that should be investigated by experiment. Both forms of dynamo should be carefully examined to determine the amount of leakage at every point. Such an investigation would be very important. Professor Rowland also advocated the use of magnets of cylindrical section, rather than flat or oval magnets, on the ground that the least amount of wire would then be used to produce the required magnetization of a given mass of iron. Professor Silvanus P. Thomson differed on this point, and preferred iron cores of oval section; giving as his reason, that he had found

by actual experiment that the central part of an iron core was not nearly so powerfully magnetized as the outer part. Professor Rowland called attention to the fact that Professor Thompson's experiments had been made with short straight iron magnets, where the resistance of the air to the magnetic lines of force came in as the most important factor, and therefore had led Professor Thompson into error; but that since in the dynamo the only air-spaces are those between the armature and the pole pieces, it closely resembles a ring magnet, where the magnetic circuit is completed in the iron itself, and therefore, as in the ring magnet, the iron in the centre of the core of the magnets of the dynamo is quite as important as that on the outside.

Professor Fitzgerald of Dublin showed that the loss due to self-induction in the armature is proportional to the linear velocity and length of the coils.

Professor Silvanus P. Thompson of Bristol called attention to the fact, that, whenever a coil is short-circuited, there is a real loss of energy in heat; and therefore it is bad to set two brushes, one a little ahead of the other, to reduce sparking, for this prolongs the time during which the single coils are short-circuited. He also noticed that since self-induction is increased in proportion to the increase in the velocity of the armature, or to the increase in the number of turns of wire which it contains, higher electro-motive force is to be best obtained by strengthening the magnetic field. The speaker then referred to the great importance of using the best soft iron in the field-magnets, instead of cast iron; stating that an English maker had nearly doubled the capacity of a machine by substituting for its old cast-iron magnets and pole-pieces new ones made of best forged iron. Professor Thompson even went so far as to say, that, in his opinion, it was important that the *grain* of the iron should run in the same direction as the lines of magnetic force. The speaker also objected to the use of large masses of iron in the magnets, on the ground that the great time required for such masses to come to their full degree of magnetization interfered with their government. Professor Elihu Thomson, on the other hand, stated that when the iron masses were small, the extra current from the machine had so high an electro-motive force as to make trouble, and, when the machine was used for arc-lights, even caused a sort of vibration in their intensity.

Prof. F. E. Nipher of Washington University, St. Louis, opened the discussion of the electrical transmission of energy by a discussion of the case of two dynamos, one being used as a generator, and one as a motor. He showed that the performance of such a system could be advantageously studied by a series of three surfaces; in each surface two of the variables being the speeds of the two machines, and the third variable being in the three surfaces respectively, the work supplied to the generator, the work done by the motor, and the efficiency of the system as indicated by the ratio of these two quantities of work.

The question of storage-batteries was discussed at considerable length. Mr. W. H. Preece of London opened by a paper upon the subject, giving his experience in the use of cells of the Planté form. He has these cells in his house; using electricity not only for lighting, but in many other ways. The cells are charged for two hours every day by a dynamo machine; but he hopes, when the cells are in a little better condition than now, to have to charge them only once a week. Each cell is made up of twelve sheets of lead about a foot square, and separated by thin sheets of hard rubber punched full of holes; the alternate plates are joined together, thus forming two sets of six plates each. Professor Dewar of Cambridge, England, gave an account of the chemistry of the storage-cell, which was of very great interest. There was considerable general discussion upon the subject of the storage-battery, and there still seems to be much to be cleared up in regard to its action. The chemical actions are by no means simple.

The subject of long-distance telephony and the difficulties that attend it was introduced by Mr. T. D. Lockwood, who in a long and interesting paper gave the results of a great deal of experience with long telephone lines. Some interesting points were brought out. The noises on telephone-lines arise not only from electro-static and electro-dynamic induction, but also from earth-currents and atmospheric electricity, imperfect contacts, and leakage from other lines. Long lines are, of course, more subject to these troubles than short ones; and lines running north and south are more subject to disturbance than those running east and west. Sometimes one end of a line will be noisy and the other quiet, as between Chicago and Milwaukee, where the Chicago end is very quiet, but the Milwaukee terminal is very noisy. Lines subject to pretty uniform leakage are less noisy than well-insulated ones; perhaps, for this reason, lines near the sea are quieter than those inland. Lines on high or mountainous land are subject to periodic storms, the noises being most intense at certain hours of the day. Lines constructed of wire of high conductivity are less noisy than those of greater resistance. Lines of small wire, thus having less electro-static capacity, are less noisy than lines of large wire. A good method of treating a noisy line is to provide a metallic return-circuit, hung parallel to the first, and similarly to it. Many of the sources of disturbance will thus be gotten rid of. In case of a long air-line, ending in a short underground cable, the person at the end of the cable can make himself heard at the other end of the line, but the man at the end of the long line can not make himself heard. For short lines, less than two miles in length, cables of insulated wire covered with tinfoil, this covering being grounded, are useful, and get rid of some sources of disturbance; but, on account of the large capacity of such a line, the retardation is very great.

Professor Fitzgerald, who was expecting to give an abstract of the paper read by Lord Rayleigh before the British association, on the subject of long-distance telephony, had been obliged to leave, so no complete presentation of Lord Rayleigh's results could be obtained: but Professor Rowland made a brief statement of the nature of the problem, that

the passage of the wave-current propagating the telephonic action was exactly similar to the sinking of the heat-waves into the earth, treated by Fourier; and by reasoning from the nature of that wave propagation he concluded that the sound of a deep bass voice could be heard farther than that of a high-pitched voice. Mr. Lockwood said that experience in ocean-cable telegraphy confirmed this. Professor Carhart stated that Lord Rayleigh had from similar considerations calculated the farthest distance at which telephonic communication could be maintained in such a cable as the Atlantic cable, and gives the extreme limit as twenty miles. This is fully confirmed by experience, according to the testimony of Messrs. Preece and Lockwood.

Capt. O. E. Michaelis, of the Frankford arsenal, read a paper in which he recommended the study of the 'structural metals,' iron, copper, brass, etc., by electrical or magnetic methods, with a view to ascertaining whether some such methods could not be devised that should detect weaknesses not otherwise to be discovered.

A short discussion then took place, on the measurement of large currents, in which there was nothing particulary interesting brought out.

Professor Rowland then took up the subject of lightning protection, and gave a short development of Maxwell's suggestion that the house should be placed in a metallic cage. A house in a complete metallic cage, one enclosing it *below* as well as above, would be completely protected if the wires of the cage were sufficiently good conductors. This fact leads to the following considerations. Lightning-rods should run down the four corners of the house and across the angles of the roof, joining at the top, thus forming the skeleton of a cage. If rods are also run down the middle of the sides of the house, or if, in a long building, two or three equidistant rods are run down the sides and connected with the rods running across the roof, so much the better. These rods must be *well* grounded, otherwise they are of no use at all, and may be worse than useless; for, suppose the gas-pipes running through the house have good earth connections, the lightning will be likely to leap from the rods to the gas-pipes, and so cause destruction. The rods down the sides should therefore be connected by rods running across *under* the building, as well as by those over the roof; and the gas and water pipes, as well as all large masses of metal in the building, should be connected with the rods by good conductors. It is, of course, necessary that the rods should be of good conducting material, — solid, not hollow. As it is important that the rods should have a large cross-section, the twisted forms with large surface and very little mass of metal are not good, as there is no use in the twisting, and the most important thing is that there should be plenty of metal to conduct. There is not the slightest necessity for insulating a lightning-rod: the safety of a building depends only on its being easier for the lightning to go around it than to go through it. Of course, from the cage of rods above described, small rods bearing points are to rise at different points on the roof. How high these should be, or how close together, is not very well determined. It is considered by some, that a rod protects the space included in the cone whose height is that of the rod, and the radius of whose base is also equal to the length of the rod. Others think that a space is protected equal to the cone whose height is that of the rod, and whose base has a radius of twice that amount.

The time for adjournment having come, the conference adjourned, subject to the call of the chairman, Professor Rowland, who is also president of the commission.

It is possible that there may be another session in Philadelphia about the close of November.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

PROCEEDINGS OF THE SECTION OF ANTHROPOLOGY.

The admirable survey of the progress of anthropological science, comprised in the address made by Dr. Tylor as president of the section, was listened to with great satisfaction by the members. In this association, as in the American, anthropology has been late in finding the recognition which its importance as a science deserves. Heretofore it has been treated as a department of the biological section. As the communications have gradually taken a wider range, and become more numerous, it was found that this subordinate status was inconvenient. At the present meeting, anthropology for the first time takes the rank of a section, and with a fortunate choice of officers, — the vice-presidents being Professors Boyd Dawkins and Dr. Daniel Wilson, and the secretaries Messrs. G. W. Bloxam (recorder), Rev. J. Campbell, Walter Hurst, and J. M. P. Lemoine.

Among the papers which attracted most attention may be ranked that of Professor Boyd Dawkins, on the range of the Eskimo in space and time. In this paper Professor Dawkins again urged with much ingenuity and force his well-known opinions as to the probability that the Eskimos are the survivors of the prehistoric race known in Europe as the 'cave-dwellers.' The Eskimos are found along the Arctic Ocean, from Labrador and Greenland to the west coast, and thence extending into Asia. Everywhere they appear to be a receding race, gradually retreating northward as they are pressed by stronger and more warlike tribes, — in America by the Indians, in Asia by the Mongols. The researches of Mr. Dall had produced evidence that they formerly dwelt on the west coast of America, far south of their present